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STUDENTS' PERCEPTION ON FACE-TO-FACE AND ONLINE MATHEMATICS LEARNING

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ABSTRACT

Covid-19's unanticipated crises had a significant impact on education. The shift from face-to-face to online learning resulted in a sudden paradigm shift in the typical setup that most students have grown accustomed to. The perception of the Bachelor of Secondary Education major in Mathematics was investigated in this study.

This study used a descriptive research design and a survey questionnaire derived from Krishnan (2016). A proportional stratified random sampling procedure was used to select 84 respondents. The significant difference between face-to-face and online mathematics learning was investigated using an independent t-test.

The findings of the study showed that majority of the respondents were between 20-21 years old. Majority of them were female. It was also found out that there was a significant difference between face-to-face and online mathematics learning. The BSEd-Math students had highly positive perception on face-to-face mathematics learning as compared to online mathematics learning. They preferred to have a face-to-face mathematics learning over online mathematics learning in terms of communication, instruction, understanding mathematics concepts, improving their ability in learning mathematics, teamwork as well as assessments. As a result, an action plan was presented to meet the students' preferred mode of learning.

KEYWORDS: Perception, Face-to-Face Mathematics Learning, Online Mathematics Learning, Descriptive research, Proportional Stratified Random Sampling & Independent t-Test

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Original Article

1. INTRODUCTION

Society drives technological change while changing technology in turn shapes society. This proves that the world has evolved through time, making technology a necessity to all humankind. The use of technology has been integrated in day-to-day life—from economic, social, political aspects and even in education. This seeks to improve and accelerate students' performance in adapting to a fast-paced society. Information and Communication Technology (ICT) reflects the evolution.

To help with the grave problem caused by COVID-19, ICT has made e-learning a crucial teaching and learning approach. This unexpected catastrophe had a significant influence on education, as schools and universities were forced to close in order to prevent the spread of the virus. The closure was imposed in 190 nations across the globe, affecting nearly 1.6 billion students (UNESCO, 2020). As a result, the government, schools, and universities have been obliged to shift from face-to-face to online learning in order to minimize disturbance and keep education going despite the current obstacles. Educational officials such as the Department of Education (DepEd) and the Commission on Higher Education (CHED) have agreed to adopt the new standard in education: the distance learning system. Community lockdown and community quarantine, as described by Tria

(2020) in Crawford et al. (2020), prompted students and teachers to study and work from home, resulting in the introduction of online learning platforms.

The shift from face-to-face to online learning causes a paradigm shift in the typical setup that most students have grown accustomed to. Face-to-Face Learning is a more traditional style of learning in which knowledge is sent from the teacher to the students (Bandara and Wijekularathna, 2017). This indicates that students are present in the physical classroom, and the teacher is using a chalkboard to discuss the topic. Meanwhile, we have begun to implement Online Learning, which is a method of giving study materials to students via a Learning Management System (Pozzi et al., 2020). It reaches out to students using online platforms such as Google Classroom and Zoom, to mention a few. Distance learning has, in fact, altered the landscape of formal education (Larreamendy, Joems and Leinhard, 2006).

According to Nguyen (Barley & Golek, 2004; Evans & Hease, 2001), the Flexible Learning System, specifically Online Distance Learning or Distance Education, has long been a feature of the American Education System and has recently become the largest sector of Distance Learning (Barley & Golek, 2004; Evans & Hease, 2001), (2015). This indicates that this method of learning existed prior to the epidemic and was used in other nations. Instead of going to school, students can speak with professors, address classmates, study materials, and complete assignments from any internet-connected location (Richardson and Swan, 2003). Since learning has become more virtual, this type of flexibility necessitates students providing mobility in their use of technology in all forms. According to Callaway (2012), the most well-known benefit of online learning is its convenience, particularly in terms of time, flexibility, and accessibility. Because most people are unable to walk outside and face-to-face learning is prohibited, this style of learning is the most viable option.

Face-to-face teaching and learning, according to Quereshi (2019) and Miles et al. (2018), improves the process through interpersonal contact. As a result, according to Atchley et al.,2013 as cited by Paul 2019, some research favors traditional classroom instruction, claiming that online learning can lack feedback for both students and instructors. Students' retention, satisfaction, and performance may be jeopardized as a result of these flaws.

As stipulated by CHED Memorandum Order No. 4 series of 2020 — Guidelines for the Implementation of Flexible Learning, Cebu Technological University-Argao Campus, a leading multidisciplinary technological university, will adopt the Flexible Learning System or e-Learning in the Academic Year 2020-2021. It is hoped that this will make the transition from traditional to flexible teaching and learning alternatives easier. During the first semester of the Flexible Learning System's implementation, the researchers noticed that several students had mixed feelings regarding the sudden shift in learning modality, particularly when it came to Mathematics. Some students preferred face-to-face math learning because they learn best when they engage with others. Some students were also raving on social media about their struggles and fears with online Math learning, which necessitates a stable internet connection and independent study.

Thus, the researchers would like to determine how the BSEd-Math students of Cebu Technological University- Argao Campus perceive face-to-face and online mathematics learning in the New Normal. The findings would be used to develop an action plan for improving Math teaching and learning in the preferred method.

2. METHODOLOGY

In this study, the researchers used a descriptive research design. The study took place at Cebu Technological University-Argao Campus in Lamacan, Argao, Cebu. The study's participants were chosen from among Cebu Technological

University's Argao Campus's BSEd-Math students. The Slovin's Formula was used to determine the number of sample responses. The study's 84 respondents were picked using a proportional stratified random sampling technique. The researchers utilized a survey questionnaire adapted from Krishnan (2016) to find out how BSEd-Math students felt about the differences between face-to-face and online mathematics learning. The data was analyzed descriptively and inferentially using Microsoft Excel and Statistical Packages for the Social Sciences (SPSS).

Figure 1: Location Map of the Research Environment (https://www.google.com/search?q=map+of+cebu&sxsrf).

3. RESULTS AND DISCUSSIONS

3.1. Demographic Profile of the Respondents in Terms of Age

Table 1 presents the age profile of the Bachelor of Secondary Education major in Mathematics students of Cebu Technological University– Argao Campus in the academic year 2020-2021. The ages were being categorized into four (4) brackets which were 18-19 years old, 20-21 years old, 22-23 years old and 24 years old and above. The table indicates the frequency and percentage of respondents being categorized according to the aforesaid age brackets. Also, the average age is presented in the same table.

As being shown in Table 1, out of 84 respondents, only 1 respondent (1.19%) belonged to 24 years old and above. Yet, 7 (8.33%) of them belonged to 22-23 years old, 54 (64.29%) of the respondents belonged to 20-21 years old and 22 (26.19%) of them belonged to 18-19 years old. Hence, the average age was 20 years old. The presented data is evident that the age bracket with the highest percentage falls under 20-21 years old and the age with the lowest percentage is 24 years old and above. This implies that the majority of the respondents are 20-21 years old to which the average age belonged.

According to Spano (2004), ages below 21 are classified as late adolescence with the ability to think and express ideas, ability to make independentdecisions, and ability to compromise. This means that the respondents are capableenough in distinguishing what are effective and not effective mode of learning mathematics.

Table 1: Demographic Profile of the Respondents in Terms of Age

Age	f	%
24 years old and above	1	1.19
22-23 years old	7	8.33
20-21 years old	54	64.29
18-19 years old	22	26.19
Total	**84**	**100.00**
Average Age	**20 years old**	

3.2 Demographic Profile of the Respondents in Terms of Gender

The students under the Bachelor of Secondary Education major in Mathematics of Cebu Technological University- Argao Campus were randomly selected. In this case, their responses from the conducted survey were accepted and interpreted for both female and male. Thus, Table 2 presents the profile of the respondents in terms of gender. The table indicates the frequency and percentage of the respondents being categorized based on their gender, namely, female and male.

As reflected in Table 2, out of 84 total respondents, 60 of them were classified as female and 24 were male. This shows that 71.43% of the respondents were female and only 28.57% were male.

Therefore, female had greater number of respondents compared to male. This implies that most of the respondents who answered the conducted survey were female. The findings also validate the findings of Moore & Tarnai (2002) in which women are more likely to participate in survey than men.

Table 2: Demographic Profile of the Respondents in Terms of Gender

Gender	f	%
Female	60	71.43
Male	24	28.57
Total	**84**	**100.00**

3.3 Respondents' Level of Perception on Face-to-Face Mathematics Learning

Face-to-face learning was a mode of learning that students relished before the advent of an online learning system. It was an instructional method in which learning materials, as well as course content, were taught in-person to a group of students. In other words, face-to-face learning required the presence of both students and instructor in order to have a live interaction. Students had different perceptions on face-to-face learning. Thus, the researchers were interested with their perception and conducted a survey in view of this learning modality.

Consequently, Table 3 presents the Perception on Face-to-Face Mathematics Learning of the Bachelor of Secondary Education major in Mathematics students of Cebu Technological University- Argao Campus. The table consists of the statements pertaining to perception on face-face mathematics learning, weighted mean of each statement, verbal description and interpretation based on the weighted mean of each statement as well as the grand mean along with its verbal description and interpretation.

Table 3 reveals the students' perception on face-to-face mathematics learning. Based on the data presented in the table, the respondents are more comfortable communicating with their classmates in a classroom environment which obtained the highest mean of 3.76. Moreover, being in class with face-to-face instruction would improve their ability to learn mathematics as it obtained a weighted mean of 3.75. Meanwhile, respondents are comfortable communicating with their instructor in a classroom which generated a mean of 3.51. However, respondents prefer to be assessed in a traditional manner (e.g. class quizzes, test) which obtained the lowest mean of 3.48. The grand weighted mean pertaining to students' perception on face-to-face mathematics learning is 3.641. The result establishes the fact that most of the students prefer face-to-face mathematics learning as they strongly agree with the statements dealing with perception on face-to-face mathematics learning. In this sense, it can be implied that students have highly positive perception on face-to-face learning. Particularly, they prefer face-to-face learning mode for communication, discussion, understanding of mathematicsconcepts, improving their learning of mathematics, teamwork and assessment.

These findings also accept the framework of the study of (Paechler & Maier,2010) that learning along with their peers in a face-to-face mathematics learning environment can benefit the students. In the collaboration of learning mathematics, students are incited to discover solutions and try out ideas together with their classmates. Interactive communication and discussion with classmates foster learning because they open opportunities to demonstrate independent thoughts.

Also, face-to-face learning provides more channels for student-teacher interaction that allows opportunities for the teachers to assist the student during activities (Paechter & Maier, 2010). According to Schreiber and Valle (2013), the guidance of the teachers helps students in mastering mathematical concepts, knowledge and skills.

Hence, students' active participation in the classroom setting influences the students learning development in learning mathematics. In terms of assessment, students can also demonstrate various skills and concepts they have equipped through traditional manner. There is no need for them to struggle with technical problems and get worried if they successfully submitted their answered quizzes, exercises or learning tasks. Also, there are no limitations in conducting performance assessments because all the students worked at the same pace.

Table 3: Perception on Face-to-Face Mathematics Learning

Statements	WM	Verbal Description	Interpretation
• I am more comfortable communicating with my instructor in a classroom environment.	3.51	Strongly Agree	Highly Positive Perception
• I am more comfortable communicating with my classmates in a classroom environment.	3.76	Strongly Agree	Highly Positive Perception
• I feel comfortable responding to questions presented in the course in the classroom environment.	3.52	Strongly Agree	Highly Positive Perception
• I would prefer face-to-face instruction.	3.71	Strongly Agree	Highly PositivePerception
• Being in class with face-to-face instruction would improve my ability to learn mathematics.	3.75	Strongly Agree	Highly PositivePerception
• Face-to-face instructions help me understand mathematics concepts better.	3.74	Strongly Agree	Highly Positive Perception
• I can easily complete the learning tasks given in a face-to-face environment.	3.56	Strongly Agree	Highly Positive Perception

• I prefer to work in classroom with my group members.	3.67	Strongly Agree	Highly Positive Perception
• It is easy to work with my team in a face-to-face environment.	3.71	Strongly Agree	Highly Positive Perception
• I prefer to be assessed in the traditional manner (e.g..class quizzes, tests).	3.48	Strongly Agree	Highly Positive Perception
Grand Mean	**3.641**	**Strongly Agree**	**Highly Positive Perception**

3.4 Respondents' Level of Perception on Online Mathematics Learning

Cebu Technological University- Argao Campus effectively implemented Flexible Learning System in the academic year 2020-2021 due to the emergence of Covid-19. Students were provided with internet connectivity kits so that they can access to the internet and learning cannot be hampered. This sequel exposed students to online learning. Online learning served as an alternative mode of learning in the battle against pandemic and education. In this modality, students had the chance to learn at their own pace. Students had different perceptions in online learning especially in the field of mathematics. Hence, researchers conducted survey on the students' perception on online mathematics learning.

Based on the data gathered from the survey, Table 4 presents the Perception on Online Mathematics Learning of the Bachelor of Secondary Education major in Mathematics students of Cebu Technological University- Argao Campus. The table consists of the statements pertaining to perception on online mathematics learning, weighted mean of each statement, verbal description and interpretation based from the weighted mean of each statement as well as the grand mean along with its verbal description and interpretation.

Table 4 shows the students' perception on online mathematics learning. Based on the data presented, students are comfortable in communicating with their classmates in an online environment which got the highest mean of 2.68. They are also comfortable in responding to questions presented in the course in an online platform and can easily complete the learning tasks given in an online environment which gained a weighted mean of both 2.58. Additionally, the students are comfortable communicating with their instructor in an online environment and prefer to be assessed using technology which gathers a weighted mean of both 2.55.

On the contrary, the data also shows that students do not prefer online instruction and they believe that this kind of learning modality would not improve their ability to learn Mathematics. The latter gained a weighted mean of 2.36 and 2.41 respectively. In addition, most of them also do not understand mathematics concepts better than face-to-face and do not prefer to work with group members or teams during online class instruction as it obtained 2.41, 2.2 and 2.24 weighted mean. The grand weighted mean of the given data is 2.445 which means students disagree with the statements pertaining to online mathematics learning.

The result yields that students are comfortable in communicating and responding in an online setting as well as completing tasks and they are open to be assessed using technology. However, students did not prefer and believe that this mode would improve their mathematics learning, can cause difficulty inunderstanding math concepts and they do not prefer to work with group or team in an online instruction. Generally, the result implies that students have negative perception on online mathematics learning.

According to Pollanen (2006), online learning offers phenomenal opportunities for communication and connection with others because there are tools and technologies which do not restrict social interaction. Yet, working with a group in an online environment is not an easy job because not all students are given the opportunity to enjoy the strong internet connection. Assurance of working with the same time frame is cannot be seen in an online environment which sometimes lead to delay of collaborative activities' accomplishment. However, a study of Kilgore (2018) states that online mathematics students do not have the ability to ask a question and get an immediate answer because not all online math classes have the same level of student engagement and one-on-one interaction with the instructor which leads them to have difficulty in understanding mathematics concepts.

Table 4: Perception on Online Mathematics Learning

Statements	WM	Verbal Description	Interpretation
• I am more comfortable communicating with my instructor in an online environment.	2.55	Agree	Positive Perception
• I am more comfortable communicating with my classmates in an online environment.	2.68	Agree	Positive Perception
• I feel comfortable responding to questions presented in the course in an online environment.	2.58	Agree	Positive Perception
• I would prefer online instruction.	2.36	Disagree	Negative Perception
• Being in class with online instruction would improve my ability to learn mathematics.	2.41	Disagree	Negative Perception
• Online instruction help me understand mathematics concepts better.	2.3	Disagree	Negative Perception
• I can easily complete the learning tasks given in an online environment.	2.58	Agree	Positive Perception
• I prefer to work online with my group members.	2.2	Disagree	Negative Perception
• It is easy to work with my team in an online environment.	2.24	Disagree	Negative Perception
• I prefer to be assessed usingtechnology (e.g. online quiz, forum, wiki).	2.55	Agree	Positive Perception
Grand Mean	**2.445**	**Disagree**	**Negative Perception**

3.5 Significant Mean Difference Between Respondents' Perception on Face-to-Face and Online Mathematics Learning

This part presents the table of independent t-test for the students' perception on face-to-face and online mathematics learning. The table indicates the result of the computation of the data needed to substantiate the content of this academic work to determine if there is a significant difference of the students' perception between face-to-face and online mathematics learning. It includes the computed t-value and the critical t-value as a basis for accepting and rejecting the null hypothesis.

As being observed from the table, the mean perception of face-to-face mathematics learning is 36.42 while the mean perception of online mathematics learning is 24.44. The computed t-value of 14.492 is bigger than the critical t-value of 1.97. Thus, the hypothesis of no significant difference was rejected. There is a significant difference in the students' perception of face-to-face mathematics learning and online mathematics learning.

In terms of communication in the field of mathematics, students are comfortable in communicating with their instructor and classmates through face-to-face communication as being compared to online. Face-to-face communication fosters higher quality of interaction than online communication. When someone delivered information, responses and feedback will be given right away. Unlike online communication, delayed responses arise due to time availability as wellas internet connection issues. In face-to-face communication, both speakers and listeners can verify the authenticity of the emotions that can be seen through facial expressions, gestures and body language. Thus, it is vital for humans to connect with others without hiding behind the screen.

With regards to instruction, there were differences between face-to-face instruction and online instruction. In face-to-face instruction, students and instructors interact in real-time. However, in online interaction, students work the learning materials at their own pace. If students do not understand a particular topic, with face-to-face instruction they can interrupt the class and ask for explanations granting an instantaneous response from their instructor. Students can also respond to questions in a face-to-face environment without distractions of unwanted noises such as crowed of the cocks. Students' active participation in face-to-face instruction would improve their ability to learn mathematics and understand mathematics concepts better. If students are given collaborative tasks, they can easily work with the team in a face-to-face environment than in an online environment. Apparently, there is an assurance of keeping in touch with the group members in a face-to-face environment while in an online environment, there is a distinct time availability and not all students are given the privilege of having a strong internet connection leading to difficulties in accomplishing assigned tasks.

Furthermore, online assessments can be easily created using various online assessment tools but crafting an assessment strategy that informs instructor's pedagogy, fosters student learning and provide accurate feedback and measure of students' success can be a challenge. Unlike in face-to-face assessments, explicit ethical dimensions, best practice to limit unethical behavior and academic honesty can be guaranteed because students' actions are not hidden by the screens.

In parallel to the study of Bali & Liu (2018), face-to-face learning showed significantly higher than online learning. There was a statistical difference in students' perception between face-to-face and online learning in terms of social presence, social interaction and satisfaction. Moreover, it is interrelated to the study of Kemp & Grieve (2014) in which students preferred to complete activities face-to-face rather than online. They strongly preferred to discuss course content with peers in the classroom rather than online. Although students enjoy the flexibility and convenience of online learning, they preferred face-to-face instruction. With face-to-face learning, instructors are able to gauge students' understanding of mathematical concepts and it is easier to generate group excitement about the course. They have a strong preference for class discussions to be conducted face-to-face, reporting that they felt more engaged, and received more immediate feedback. Although social connectedness can be derived online, most students felt that face-to-face interaction is essential for building a sense of community. Hence, students' experience in online classes is different from face-to-face classes and patterns of engagement seem to differ between the two modalities of learning.

Table 5: Significant Mean Difference Between Respondents' Perception on Face-to-Face and Online Mathematics Learning

Mathematics Learning Mode	Mean	StandardDeviation	Computed t-value	Critical t-value	Decision	Interpretation
Face-to-Face	36.42	4.521	14.492	1.97	Reject H_o	Significant
Online	24.44	6.077				

5. CONCLUSIONS

There was a significant difference in respondents' perceptions of face-to-face and online mathematics education, according to the study's findings. In comparison to online mathematics learning, the BSEd-Math students who took part in this study had a very positive opinion of face-to-face mathematics learning. As a result, BSEd-Math students prefer in-person mathematics instruction to online mathematics instruction.

These findings support Lev Vygotsky's (1978) Social Constructivism Theory, which emphasizes face-to-face learning as an effective learning environment and includes a strong voice in math instruction, as cited by McLeod (2020). This highlighted the significance of human relationships, active learner participation, and collaborative aspects of the learning process, particularly in the discipline of mathematics. Furthermore, Garrison, Anderson, and Archer (2000)'s Community of Inquiry Theory embraces the fact that learning occurs through the interaction of social, cognitive, and teaching presences, as well as promotes critical thinking, deep and meaningful learning, and internal motivation in both synchronous and asynchronous spaces. However, the findings revealed that BSEd-Math students dislike online mathematics learning due to internet connection issues, which resulted in a delay in completing collaborative tasks, obtaining responses and feedback, and having difficulty understanding mathematics ideas. As a result, while accepting Social Constructivism Theory, this study rejects Community Constructivism Theory.

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6. REFERENCES

A. BOOKS

1. *Hoffman, S. & Asmundson, G.J (2017). Learning Principles in CBT. The Science of Cognitive Behavioral Therapy*
2. *Okita S.Y. (2012) Social Interactions and Learning. In: Seel N.M.(eds) Encyclopedia of the Sciences of Learning*

B. LEGAL BASIS

1. *CMO-No.-4-s.-2020-Guidelines-on-the-Implementation-of-Flexible-Learning.pdf*
2. *Department of Education (2020). Shared Responsibility:Recommendation on Limited Face-to-Face*

C. JOURNALS

1. *Bali, S. & Liu, MC. (2018). Students' Perceptions Toward Online Learning and Face-to-Face Learning Courses. Journal of Physics:Conference Series, 1108(1):012094*
2. *Bandara D, Wijekularathna DK (2017). Comparison of Student Performance under Two Teaching Methods: Face to Face and Online. The International Journal of Educational Research, 12 (1),69-79.*
3. *Callaway, S.K. (2012). Implications of Online Learning: Measuring Student Satisfaction and Learning for Online and*

Traditional Students. Insights to a Changing World. Journal (2).

4. *Cobb, P., Hodge, L. L. (2002). A Relational Perspective on Issues of Cultural Diversity and Equity as They Play Out in the Mathematics Classroom. Mathematical Thinking and Learning, 4, 249-284.*
5. *Diaz, S., et al (2010). An Analysis of Students' Perceptions of the Value and Efficacy of Instructors' Auditory and Text-Based Feedback*
6. *Modalities across Multiple Conceptual Levels. Journal of Educational Computing Research, 43(1), 113-134.*
7. *Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education Model. The Internet and Higher Education, 2(2-3), 87-105.*
8. *Garrison, D. R., Anderson, T. & Archer, W. (2001). Critical Thinking, Cognitive Presence, and Computer Conferencing in Distance Education. American Journal of Distance Education, 15(1), 7-23.*
9. *Hughes, J. E., et al (2007). Academic Achievement and Perceptions of the Learning Environment in Virtual and Traditional Secondary Mathematics Classrooms. The American Journal of Distance Education, 21(4),199-214.*
10. *Krishnan, S., (2016). Students' Perceptions of Learning Mode in Mathematics. The Malaysian Online JournalEducational Sciences, 4(2), 32-41.*
11. *Larreamendy-Joerns, J., & Leinhardt, G. (2006). Going the Distance with Online Education. Review of Educational Research, 76(4), 567-605.*
12. *Moore, D. L., & Tarnai, J. (2002). Evaluating nonresponse error in mailsurveys. In: Groves, R. M., Dillman, D. A., Eltinge, J. L., and Little, R. J. A. (eds.), Survey Nonresponse, John Wiley & Sons, New York,pp. 197–211.*
13. *Motudi, P. & Ngirande, H. (2014). The Influence of Students` Perceptions on Mathematics Performance. A Case of a Selected High School in South Africa. Mediterranean Journal of Social Sciences, 5 (3), 431- 445.*
14. *Nguyen, T. (2015). The Effectiveness of Online Learning: Beyond No Significant Difference and Future Horizons. MERLOT Journal of Online Learning and Teaching, 11 (2), 309-319.*
15. *Paechter, M., Maier, B. and Macher, D. (2010). Students' Expectations of and Experiences in E-Learning: Their Relation to Learning Achievements and Course Satisfaction. Computers & Education, 54, 222-229.*
16. *Powell, K.& Kalina, C. (2009). Cognitive and Social Constructivism: Developing Tools for an Effective Classroom. Institute of EducationSciences,130(2), 241-250.*
17. *Pozzi, F., Asensio-Perez, I., Ceregini, A., Dagnino, FM, Dimitriadis, Y. & Earp, J. (2020) Supporting and Representing Learning Design with Digital Tools: In Between Guidance and Flexibility, Technology, Pedagogy and Education, 29(1), 109-128.*
18. *Qureshi, JA., (2019). Advancement in Massive Open Online Courses (MOOCs) to Revolutionize Disruptive Technology in Education: A Case of Pakistan. Journal of Education and Educational Development 6(2), 219-234.*
19. *Richardson, J. & Swan K. (2019). Examining Social Presence in Online Courses in Relation to Students' Perceived Learning and Satisfaction. The Official Journal of OLC, 7(1). 68-88.*
20. *Rogers, P., & Lea, M. (2005). Social Presence in Distributed Group Environments: The Role of Social Identity, Behaviour & Information Technology, 24(2), 151–158.*
21. *Schreiber, L. M., & Valle, B. E. (2013). Social Constructivist Teaching Strategies in the Small Group Classroom. Small Group Research, 44(4), 395–411.*

22. *Swan, K. (2001). Virtual Interactivity: Design Factors Affecting Student Satisfaction and Perceived Learning in Asynchronous Online Courses. Distance Education, 22(2), 306–331.*

D. UNPUBLISHED MATERIALS

1. *Annand, D. (2011). Social Presence within the Community ofInquiry Framework. Research Gate*
2. *Garrison, D.R (2009). Communities of Inquiry in Online Learning. Research Gate*
3. *Paul, J. & Jefferson, F. (2019). A Comparative Analysis of Student Performance in an Online vs. Face-to-Face Environmental Science Cours From 2009 to 2016. Frontiers in*
4. *Pollanen, M. (2006). Interactive Web-Based Mathematics Communication. MAA*
5. *Sessoms, C.J. (2016). Teachers' Perspectives: Face-to-Face and Computer-Based Instruction in Math. Scholar works Waldenu Edu*
6. *Shea, P. & Bidjerano, T. (2009). Community of Inquiry as a Theoretical Framework to Foster "Epistemic Engagement" and "Cognitive Presence" in Online Education. Research Gate*

E. ELECTRONIC DEVICES

1. *Gates, S. (2018). Benefits of Collaboration. Retrieved from https://www.nea.org/professional-excellence/student-engagement/tools-tips/benefits-collaboration.*
2. *Headspace, National Youth Mental Health Foundation Ltd (2021). Face to Face vs Online Learning. Retrieved from https://headspace.org.au/young-people/face-to-face-vs-online- learning/.*
3. *Kemp, N. & Grieve, R. (2014). Face-to-Face or Face-to-Screen? Undergraduates' Opinions and Test Performance in Classroom vs. Online Learning. Front. Psychol., 12. Retrieved from https:// www. frontiersin. org/articles/ 10.3389/ fpsyg.2014.01278/full*
4. *Kilgore, P.A. (2018). Adult College Students' Perceptions about Learning Mathematics via Developmental Mathematical xMOOCs.Retrieved from https://scholarcommons.usf.edu/cgi/viewcontent. cgi?article=8376&con context=etd*
5. *Lynch, M. (2016). Social Constructivism in Education. Retrieved from https://www.theedadvocate.org/social-constructivism-in-education/.*
6. *McLeod, S. A. (2020). Lev Vygotsky's Sociocultural Theory. Simply Psychology. Retrieved from https://www.simplypsychology.org/vygotsky.html*
7. *National Communication Association (2008). Face-to-Face or Online Instruction?Face-to-Face is Better. Retrieved from https://www.natcom.org/communication-currents/face-to-face-or online-instruction-face-face-better.*
8. *Resilient Educator (2021). Authentic Assessment Methods for Mathematics. Retrieved from https://resilienteducator.com/classroom- resources/authentic-assessment-methods-for-mathematics/.*
9. *Spano, S. (2004). Stages of adolescent development. Retrieved from https://www.actforyouth.net/resources/rf/rf_stages_0504.cfm?fbclid=IwAR3dIXA-ejdu2OlqXU5ur0-K1o_36 1NXEL3xmg1IMnz1lZxmcpxedB9XQ4*
10. *Tria, J. (2020). The COVID-19 Pandemic through the Lens of Education in the Philippines: The New Normal. Retrieved from https://www.researchgate.net/publication/341981898_The_COVID-19_Pandemic_through_the_Lens_of_Education_in_the_Philippines_The_New_Normal. November 23, 2020.*

11. *UNESCO (2020). Policy Brief: Education during COVID-19 and beyond. Retrieved from https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf*
12. *Leung, Chi-Hong, Winslet Ting-Yan Chan, and Ivy Siok-Ngoh Chen. "Teaching To Enhance Student Learning From A Perspective Of Brain Functions." International Journal of Educational Science and Research (IJESR) 6 (2016): 11-20.*
13. *Saini, Kuldeep, and Akash Saxena. "Online power system contingency screening and ranking methods using radial basis neural networks." International Journal of Electrical and Electronics Engineering Research (IJEEER) ISSN (P) (2016).*
14. *Ua-Umakul, A. N. O. N., and O. R. R. A. P. H. A. T. K. A. N. Chaiwatchatuphon. "the effects of using STEM project-based learning activities on environmental problem-solving ability of upper secondary school students in bangkok metropolis." International Journal of Educational Science and Research 8.1 (2018): 1-8.*
15. *Durgabai, R. P. L., and P. Bhargavi. "Pest management using machine learning algorithms: a review." International Journal of Computer Science Engineering and Information Technology Research (IJCSEITR) 8.1 (2018): 13-22.*